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GAS ABSTRACTS

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CONTENTS

1. Gas Industry 257
2. Appliances 259
3. Combustion and Industrial Furnaces 260
4. Carbonization and Gasification 262
5. Natural Gas and Natural Gas Condensates 268
6. Petroleum and Synthetic Liquid Fuels 271
7. Analytical Methods and Tests 273
8. General and Physical Chemistry 276
10. Chemical Engineering 276
11. Process Equipment and Instrumentation 278
12. Materials of Construction 280

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1. GAS INDUSTRY

Financing

Bashore, E. NEW MONEY AND OUR EXPANDING FACILITIES. *Gas Age* **104**, 18-21, 50-52 (1949) *September* 29.

The gas industry has been able to raise funds for its unprecedented postwar expansion in spite of an increasing reluctance of individual investors to supply risk capital. Life insurance has largely replaced stocks as the investment medium for personal savings. The tax laws have tended more and more to remove the incentives for supplying equity capital. Public utilities have been least hard hit by the disappearance of equity capital because they can safely finance largely through debt capital and because their bonds are attractive as a safe investment for insurance companies, institutions and individuals. However, a very real danger exists that the lack of risk capital in some future period, when corporate earnings are insufficient to sustain an expanding economy, will result in the substitution of government financing for private enterprise. When that happens we will have arrived at socialism. Continued progress and the nation's existence as a republic demand a restoration of the incentives to risk for the purpose of gain. To restore these incentives will require a reversal of the taxation trend and a return to the theory that intelligent self-interest is not antisocial but rather the driving force necessary to increase production for more abundant living in a free society.

J. C. Lane

Falvey, J. F. LENDERS EXPRESS DIVERGENT VIEWS ON DEBT FINANCING POLICIES. *Am. Gas J.* **171**, 22, 24 (1949) *October.*

The pros and cons of high-debt-ratio financing as currently practiced by natural gas transmission companies are discussed. Some believe that extensive debt financing in prosperous times precludes the opportunity to obtain additional funds during a possible future depression. Others feel that the stability inherent in the gas transmission industry renders the industry substantially immune to the dangers generally stressed as inherent in high-debt-ratio financing. Cogent arguments for both beliefs are presented.

J. C. Lane

UTILITY FINANCING STUDY HELPS INDIVIDUAL COMPANIES. *Am. Gas Assoc. Monthly* **31**, 4-6, 40 (1949) *October.*

The survey of utility financing methods recently completed under the joint sponsorship of the American Gas Association and the Edison Electric Institute should prove helpful to individual gas and electric companies in choosing the methods best adapted to their specific situations. The factors which have led to difficulty in attracting equity capital are discussed in detail and suggestions for making stock issues more attractive to investors are presented. A financial public relations program to acquaint investors with factual material on the advantages of utilities offerings and to allay fears of government competition and high operating costs is outlined. The media for such a program are discussed, their functions are described and their effectiveness is assessed. The characteristics of the various types of securities are explained and their appeal both to the company and to the investor is analyzed.

J. C. Lane

Fuel Resources

Solliday, A. L. WHEN DO WE NEED A SYNTHETIC FUEL INDUSTRY? *J. Petroleum Technol.* **1**, (*Section* 1) 4-8 (1949) *October.*

Based on a detailed analysis of probable future demand versus supply from existing wells, known reserves, predicted discoveries and imports, it is concluded that the national economy does not require production of synthetic liquid fuels for at least another 10 years, even in the case of war. The next decade should be utilized for laboratory and pilot-plant research on synthetic processes, but not to build costly "demonstration plants" which are not flexible enough for research and development and are hence subject to obsolescence. Private industry can do this job unaided, and the spirit of competition will supply incentive lacking in government-financed projects. Government research at the pilot-plant level should be encouraged, but

the building of demonstration plants should be recognized as a costly, inefficient burden upon the taxpayer.

J. C. Lane

Uren, L. C. UN RESOURCES CONFERENCE. *Petroleum Engr.* **21A**, 44-45, 48, 53, 55, 58 (1949) *October.*

The United Nations Resources Conference which began August 17, 1949, and continued for nearly three weeks included the presentation of a number of papers on fuel resources, conservation, production techniques and utilization. Many of these papers were specially prepared by men recognized as leaders in their fields. Subjects covered included coal production, underground gasification, coal carbonization, coal preparation, techniques of oil and gas recovery and field development, production techniques for oil, gas and shale oil, synthetic fuel production, utilization of energy, and utilization and conservation of fuel in space heating. It is contemplated that the papers will be printed, incorporated into volumes and made available to all who may be interested.

J. C. Lane

Pipe Lines

Reed, P. MAJOR PIPE-LINE CONSTRUCTION PROJECTS. *Oil Gas J.* **48**, 326, 328, 332, 334, 337, 339-340 (1949) *October* 6.

Approximately 35,600 miles of pipe line are planned for construction here and abroad. Domestic natural gas construction leads with 17,700 miles to be laid in the next few years. The principal gas, crude oil and products lines are listed with their lengths, diameters, construction status, locations and completion dates.

J. C. Lane

Titus, E. HOW NEW ENGLAND MAY GET NATURAL GAS. *Gas* **25**, 89-91 (1949) *October.*

Northeastern Gas Transmission Company, a wholly-owned subsidiary of Tennessee Gas Transmission Company, has asked the Federal Power Commission for a certificate for the construction and operation of some 511 miles of pipe lines and laterals to bring natural gas to New England. The system will have a delivery capacity of 350 MMcf per day, equal to the estimated requirements for three to five years after the service is initiated. The Northeastern line will have two sources of supply, the Tennessee Gas Transmission line which will be extended east from Buffalo and Transcontinental Gas Pipe Line Company's line which will be extended from New York City to the Connecticut border.

J. C. Lane

Reserves

Crowell, A. M. LOUISIANA NATION'S GREATEST RESERVE OF NATURAL GAS? *Gas* **25**, 105-106 (1949) *September.*

The author reports briefly on a survey of the gas reserves in Louisiana made for a proposed pipe line. On the basis of the data gathered, the author concludes that Louisiana is the state of greatest reserves of natural gas. More than half of the wells are closed awaiting a market. In producing fields there are both producing and non producing wells causing disproportionate withdrawals of gas. Retarding factors in the development have been the 7-year period of non-export policy by the state, relatively higher taxes, and the lack of more than two major markets. However the state has reversed the export policy and this together with other factors may result in a posted price for gas yet.

O. T. Bloomer

2. APPLIANCES

Burner

Betz, P. L. (assigned to Consolidated Gas Electric Light & Power Company of Baltimore) GAS BURNER WITH THERMOCOUPLE. U.S. 2,482,238 (1949) *September* 20.

Four claims are made for a thermoelectric safety pilot design which utilizes forced convection to cool the hot junction in cases of flame failure. Several different schemes are illustrated.

E. F. Davis

Interchangeability

INTERCHANGEABILITY OF OTHER FUEL GASES WITH CARBURETTED WATER GASES. *Am. Gas Assoc. Testing Laboratories Research Report* 1106-B, 1-36 (1948) *December.*

This second report in a series on Mixed Gas Research (see Gas Abstracts 5, 17, February, 1949) presents in tabulated form, the performance characteristics of some 25 supplemental gases on appliances and pilots adjusted for 3 carburetted water gases: (1) 535 Btu, 0.68 sp gr. of medium inert content; (2) 535 Btu, 0.73 sp gr, of high inert content; and (3) 535 Btu, 0.63 sp gr of low inert content. In connection with these studies, data were obtained on 7 test burners and on a thermal conductivity apparatus, and calculations of various interchangeability indices were made. The limits in which the supplemental gases may be mixed with the adjustment gases are indicated. The limiting characteristics in decreasing order of frequency are lifting, yellow tips, incomplete combustion and flash back. Certain test burners are of value in predicting lifting and yellow tips, but none are adequate from the standpoint of general performance. Preliminary correlations of the thermal conductivity readings with lifting performance are encouraging. None of the available indices of interchangeability are completely satisfactory, but it appears that the most reliable are the three natural gas indices for lifting, yellow tips and flash back. A final correlation of the data tabulated here is forthcoming.

A. J. Rudnitzki

INTERCHANGEABILITY OF OTHER FUEL GASES WITH A MIXED COKE OVEN-CARBURETTED WATER GAS. Am. Gas Assoc. Testing Laboratories Research Report 1106-C, 1-30 (1949) January.

The third publication in this series on Mixed Gas Research describes the performance of 33 supplemental gases on appliances adjusted for a mixed coke-oven and carburetted water gas of 535 Btu and 0.55 sp gr. The extents to which the supplemental gases may be mixed with the adjustment gas are tabulated and the limiting performance factors are indicated. Several test burners showed promise in predicting decidedly poor performance with respect to lifting and yellow tips, but were inadequate from the standpoint of flash back and incomplete combustion. With respect to lifting, thermal conductivity measurements show more promise than test burners. The natural gas indices for lifting and yellow tips are the most satisfactory of the available indices of interchangeability. The handbook data presented in this report are to be correlated in a later publication.

A. J. Rudnitzki

INTERCHANGEABILITY OF CARBURETTED WATER GASES WITH A MIXED NATURAL GAS-BLUE GAS-CRACKED NATURAL GAS-PRODUCER GAS. Am. Gas Assoc. Testing Laboratories Research Report 1106-D, 1-36 (1949) April.

The fourth report on AGA Mixed Gas Research describes performance tests of 13 widely varying carburetted water gases on appliances adjusted for a mixed natural gas-blue gas-cracked natural gas-producer gas of 535 Btu and 0.62 sp gr. Ten of the carburetted water gases are substitutable to the extent of 100%. The directions in which the compositions may be varied to produce interchangeable mixtures are indicated. The observations made in earlier reports concerning the adequacies of test burners and interchangeability indices are, in general, confirmed but, in the present instance, the supporting data are not as extensive. This report completes the presentation of the experimental data and is to be followed by a final bulletin in which the data will be expressed mathematically.

A. J. Rudnitzki

LP Gas

Szitar, J. DOMESTIC INSTALLATIONS—7 SAFE STEPS. PART II. *Butane-Propane News* **11**, 78-80, 82, 86, 90, 92, 94 (1949) *October.*

Some of the recommended safe practices in selecting the proper type of LP-gas storage tank, in sizing the tank and pipe for normal installations, and in testing the system are given. A final and important step in providing safe installations is to give adequate instruction on the operation of the system to the consumer.

E. F. Davis

Space Heating

Korsgren, T. Y. (assigned to Stewart-Warner Corp.) GAS BURNING SPACE HEATER. U.S. 2,482,552 (1949) September 20.

Four claims are made for a forced air gas-fired floor furnace. The blower supplies primary and secondary air and also circulates heated air to the room separate from the combustion air.

E. F. Davis

Venting

Dean, C. H. EDUCATION AND REGULATION COMBINED CAN SOLVE VENTING PROBLEMS. *Am. Gas J.* **171**, 35-36 (1949) *October.*

The cleanliness, convenience and versatility of gas encourages its abuse. No one would attempt slip-shod methods of venting coal or oil appliances. The gas industry is faced with a problem in education to teach home builders, installation men and home owners that proper venting is essential with space heaters and highly desirable with ranges, the latter more to remove cooking odors than as a condensation problem. Exhaust fans are not a complete solution without supplying inlet air to replace the air exhausted. Appliance manufacturers should supply simple, foolproof instructions for installation.

J. C. Lane

Water Heaters

Hewey, H. D. PROGRESS IN GAS WATER HEATING. *Am. Gas Assoc. Monthly* **31**, 13-14 (1949) *October.*

In order to increase the income from gas operations this combination utility set up a self-supporting automatic storage water heater rental program which resulted in an increased income of $388,000 in one year. 15,808 water heaters, of which 75% are 15 gallon capacity, have been rented. The rental costs, which are borne by the customer, range from $1.15 per month to $1.40 per month for 15 gallon and 30 gallon sizes respectively.

E. F. Davis

The following article, the abstract for which appears on the page indicated, is also called to your attention:

MacLean, A. D. THE CAPACITY OF BALANCED VALVE REGULATORS. p. 265.

3. COMBUSTION AND INDUSTRIAL FURNACES

Burners

Eiseman, J. H. A STUDY OF LABORATORY BUNSEN BURNERS FOR NATURAL GAS. *J. Research Natl. Bur. Standards* **42**, 541-566 (1949) *June.*

A study of eight representative Meker-type and eight representative straight-tube type laboratory burners, recommended for use with natural gas, indicates that performance can be improved by redesign. The basic principles of burner design are set forth. Experimentally, it is shown that these principles, which were first obtained for appliance burners, apply also to laboratory burners. For satisfactory performance a Meker burner should deliver 10,000 Btu/hr and a straight-tube burner, 5,000 Btu-hr at about 70% primary aeration. In most cases, unsatisfactory performance can be attributed to inadequate port area, improper throat/port area ratio, insufficient primary air opening, and improper orifice size. The modification of two burners so that they complied with design requirements resulted in satisfactory operation.

A. J. Rudnitzki

Changeover

Richardson, H. K. GAS CHANGE MAY REQUIRE UNUSUAL SKILL TO EFFECT EFFICIENT UTILIZATION. *Am. Gas J.* 171, 16-19 (1949) *October.*

In the conversion of manufactured gas to natural gas the factors of flame propagation and temperature have a marked effect on: (1) actual burner design — particularly pilotage; (2) heat release for definite port area; and (3) operator's handling of burner adjustment. Specific data on the factors affected are given for changeover of glass sealing and shaping machinery. When changing from manufactured gas to straight natural gas on lamp working machines it has been found that about 10% more Btu are required with the natural gas to do the same work.

E. F. Davis

Combustion

Barr, J. COMBUSTION IN VITIATED ATMOSPHERES. II. SOME PRELIMINARY STUDIES OF DIFFUSION FLAMES. *Fuel* (British) 28, 200-205 (1949) *September.*

Diffusion flames of mixed butane-propane in air and vitiated air (containing recirculated combustion products) have been studied experimentally, to determine the separate effects of air and fuel velocities, vitiation, and pressure on flame heights. Fick's law of diffusion provides a basis for the correlation of flame heights as affected by air and fuel velocities. A general application of the theory yields a correlation in which a family of curves represents the range of vitiation. From the latter correlation, it appears that flame height is negligibly affected by recirculation of combustion products provided diffusion is the controlling variable. This conclusion is being checked experimentally.

A. J. Rudnitzki

Mullins, B. P. COMBUSTION IN VITIATED ATMOSPHERES. III. EFFECT OF OXYGEN CONCENTRATION ON IGNITION INDUCTION PERIOD. *Fuel* (British) 28, 205-207 (1949) *September.*

Preliminary experiments on the time lag of ignition in kerosene-air mixtures containing products of combustion yield the correlation:

$$ta^2 = 10^{-10} \exp (24{,}000/T)$$

where t = time lag in milliseconds, a = oxygen index (fraction O_2 in the vitiated air) and T = temperature °K. This work is being amplified.

A. J. Rudnitzki

Barr, J. and Mullins, B. P. COMBUSTION IN VITIATED ATMOSPHERES. IV-PERFORMANCE OF A TYPICAL COMBUSTION CHAMBER. *Fuel* (British) 28, 225-228 (1949) *October.*

In a gas turbine combustion chamber, flame extinction is encountered at a lower limit fuel/air ratio = 0.00939 — 0.0000051T — 0.032a, where T = inlet temperature °C and a = volume fraction of oxygen in the vitiated air (a = 0.21 for pure air). No higher limit of stability was observed for pure or slightly vitiated air, but at high vitiation an unstable flame was established downstream from the usual combustion zone and a further increase of the fuel/air ratio caused extinction. An increase in vitiation lengthens the flame, an increase in temperature shortens it, and vitiation decreases combustion efficiency.

A. J. Rudnitzki

Mullins, B. P. and Barr, J. COMBUSTION IN VITIATED ATMOSPHERES. V. APPLICATION OF RESULTS. *Fuel* (British) 28, 228-230 (1949) *October.*

The implications of the studies described in the four preceding papers of this series are discussed from the standpoint of flame stability, flame length and combustion efficiency. It is indicated that the practice in combustion studies of employing slave combustion chambers to heat the air supply is not without effect on the experimental results. In a cycle modified for recirculation of the combustion products, additional primary air at a lower mean velocity will be required. In the industrial gas turbine, a shorter flame length may be expected if the recirculated gases are added before the primary combustion zone rather than after.

A. J. Rudnitzki

Controlled Atmospheres

Spencer, L. F., Manual 53: CONTROLLED ATMOSPHERES FOR METALS. *Materials and Methods* 30, 84-92 (1949) *October.*

The author discusses the use of controlled atmospheres to promote and prevent surface reactions on metals. Although the discussion is chiefly about protective atmospheres, nitriding and carburizing are also discussed. Tables are used to illustrate the source, use, advantages, and limitations of all types of atmospheres.

E. F. Davis

Explosions

CAUSES AND CURES FOR EXPLOSIONS IN COMPRESSED AIR SYSTEMS. *Petroleum Processing* 4, 1101-1102 (1949) *October.*

The Bureau of Mines has demonstrated the formation of a carbon-oxygen complex on the carbon deposits in air compressors. The complex is regarded as a possible initiator of explosions and may account for the presence of carbon monoxide in compressed-air systems. Preventative measures suggested include the development of a lubricant which inhibits the action of the complex, and the use of temperature sensitive shut-off mechanisms to prevent development of excess temperatures in discharge lines.

O. T. Bloomer

Furnaces

Brunklaus, J. H. HEAT AND PRESSURE DISTRIBUTION INSIDE INDUSTRIAL FURNACES. *Ind. Gas* 28, 16-18, 23-26 (1949) *September.*

The pressure differences from top to bottom of a furnace depends on the height (h) and are linked together by a linear function (a) and (h), (a) being a parameter varying with difference in temperature of the flue gases and the air outside the oven and their densities. Experimental evidence is given to show that furnaces employing atmospheric burners and a bottom flue can have a much better thermal efficiency since the furnace is being run under pressure and the walls are soaked with heat.

E. F. Davis

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Thomas, N. STRUCTURE AND STABILITY OF BURNER FLAMES. p. 276.

4. CARBONIZATION AND GASIFICATION

Carbonization

Marecaux, P. (assigned to Societe Anonyme, France) CARBONIZATION PLANT. U.S. 2,478,295 (1949) August 9.

This improved plant for low temperature carbonization of coals, or oil shales, consists of two vertical, coaxial tubes, with the solid raw material being fed at the top into the annular space. The outer tube is heated by spirally-arranged flues which carry combustion gases from the spent shale. The inner tube, which rotates, carries a spiral lifting-band to mix the down-moving shale and is perforated by gas-outlet ports and steam-inlet ports. Steam superheated by the combustion gas stream, is introduced through a rotating packed joint to the inner space of the rotating tube, whence it passes through a spaced series of steam ports into the hot shale bed, sweeps out the oil and gases, and reenters the rotating tube by a second series of spaced ports which communicate with several vertical collecting tubes mounted on the inner wall of the rotating tube. These collecting tubes convey the oil vapors to a shale-sealed space at the bottom of the rotating tube from which they are sucked out by an exhauster to a condensing system. The spent shale falls from the annular space at the bottom of the rotator through a chute and valve onto a step-grate furnace where it burns to provide heating-gases for the vertical cylinders. The distillation gas also may be burned for this purpose. The hot waste gas from the flues of this distillation unit are used to dry and preheat the crushed shale in a separate vertical shaft furnace.

O. P. Brysch

CARBONIZING TEST FIGURES. *Gas J.* (British) **259**, 647-649 (1949) *September* 14.

In order to compare yields of gas from carbonization processes, corrections must be made for adventitious inerts, consisting of flue gas and gases resulting from air drawn in at bottom of retort or through the main. The calculation of the yield to a standard inert content may be made by first assuming that all of the oxygen has come from air, and that the adventitious nitrogen is equal to the total nitrogen minus 120 cu ft per ton of coal. By assuming the composition of the gas in the flues to be intermediate between producer gas and its completely oxidized products of combustion, accompanying gases may be calculated by multiplying the adventitious nitrogen by the following factors: (1) for CO_2, 0.18; (2) for CO, 0.28; and (3) for H_2, 0.11. Examples are given of the correction of two gases to standard inert content.

W. E. Ball

Abstractor's Note: The factors given may be strictly applied only to steamed retorts heated with producer gas. However, the method of calculation may be used for any fuel gas or carbonization process.

COOLING AND CONDENSATION OF GASES FROM CARBONIZING PLANTS. *Coke & Gas* (British) **11**, 315-320 (1949) *September*.

Spray cooling of carbonization gases with large volumes of liquor has been found to be the most satisfactory procedure from the practical standpoint, but is thermodynamically unsound. The sensible heat, at high potential, is converted into latent heat, at a low potential, making utilization difficult. Methods proposed include using the warmed cooling water for steam raising, and transformation into high pressure steam by means of a heat pump. A study of practical results with a gas condenser emphasized the importance of a high gas velocity, although the data could not be correlated with fundamental equations. It is believed that an atmospheric condenser with forced or induced draught, and with water circulated over the tubes, would prove to be a compact and efficient unit.

W. E. Ball

Carbonizing Properties

Davis, J. D., Reynolds, D. A., Brewer, R. E., Ode, W. H., Naugle, B. W., and Wolfson, D. E. CARBONIZING PROPERTIES OF LOWER BANNER COAL FROM NO. 56 MINE, DANTE, RUSSELL COUNTY, VA. U.S. Bureau of Mines Technical Paper 720, 1-45 (1949).

The Lower Banner-bed coal, No. 56 mine, Dante, Russell County, Virginia is coal No. 91 in the series of BM-AGA coal carbonization studies. This coal is of high volatile A bituminous rank. Blends with Pocahontas No. 3 low volatile (coal 75) and Upper Banner (coal 92) were tested. Yields at 900°C (18-in. retort) approximated the average yields from 25 high-volatile A coals. Cokes made at all temperatures were well fused, and at high temperatures the cokes were slightly lower in strength indexes than the average of 25 high-volatile A coals. Strong contraction was shown and less resistance to oxidation than Pittsburgh bed coal.

O. P. Brysch

Catalytic Cracking

Loughry, T. F. ECOMOMICS OF CATALYTIC GAS CRACKING APPLIED TO EASTERN NATURAL GAS. *Gas Age* **104**, 87-89 109-110 (1949) *October* 13.

With natural gas available to eastern manufactured gas companies, catalytic cracking offers attractive possibilities for producing base load gas as well as for meeting peak loads. A hypothetical company is considered with maximum sendouts of 14, 16, 19.2 and 21.8 MMcf of 540 Btu gas. Based on assumed demand and commodity charges for natural gas, the savings in costs of materials provided by catalytic cracking over straight natural gas operation are computed. Cost of the catalytic plant for 14 MMcf sendout is "in the neighborhood of $750,000 complete and ready to operate."

C. H. Riesz

Coal Oxidation

Berman, N. and Howard, H. C. WATER-SOLUBLE POLYCARBOXYLIC ACIDS FROM OXIDATION OF BITUMINOUS COAL. *Anal. Chem.* **21**, 1200-1202 (1949) *October.*

The modified Menzies-Wright molecular weight apparatus was applied to the determination of the molecular weights of the water-soluble polycarboxylic acids obtained by alkaline oxidation of bituminous coal. Acetone and methyl ethyl ketone were used as solvents. Benzoic, salicylic, phthalic, and mellitic acids were used as standards to determine the constant which relates the rise of the water thermometer and the molal concentration. The constant was then applied to determining the molecular weights of mixed and averaged fractionated acids from coal. Good agreement of both values was found.

O. P. Brysch

Jones, R. E. and Townend, D. T. A. THE OXIDATION OF COAL *J. Soc. Chem. Ind.* (British) **68**, 197-201 (1949) *July.*

The authors report on a careful study of oxidation of coal and carbon in the pre-ignition stages. A *peroxygen* complex, detected by its oxidation of ferrous thiocyanate, was formed in the presence of water at temperatures up to 70°C. This was relatively stable with slight amounts of CO as the main gaseous product. For a given time of exposure, above 70°C the peroxygen complex began to break down with increasing oxygen content of remaining coal-substance, and increased ulmification and increased CO_2 formation. At 350°C the peroxygen complex appears to be completely destroyed. Atmospheric oxidation of six coals shows the peroxygen content to reach a higher value earlier in the exposure the lower the coal rank, but to pass through a minimum at coals of 89% carbon (pure coal) and to increase again with anthracites. Since the peroxygen content attains a maximum while the overall oxidation of the coal proceeds unchecked, it must be supposed either that (1) the complex is rendered less stable by the presence of one of the products of reaction or (2) that the overall oxidation can also proceed by an alternative mechanism. The breakdown of the complex probably provides radicals which, by chain mechanisms, produce the overall reaction.

O. P. Brysch

Sanderson, T. THE QUALITY OF COKE FOR BLAST FURNACES. *Gas World* (British) **130**, Supplement 119-122 (1949) *October.*

The four-fold function of coke in the blast furnace is to supply: (a) necessary heat; (b) reducing medium; (c) carbon for pig iron; and (d) support for furnace burden. The high standards required in all four functions are often impossible to attain due to incompatibility of the necessary coke properties. The shatter test as usually reported, plus 2-in., or plus 1½-in., is difficult or impossible to correlate with blast furnace results, whereas the "minus ½-in." index may follow closely the amount of breeze removed before charging and the overall furnace results, as it indicates probable abrasion losses and void blockage in the furnace. A composite index comprising original coke size, shatter or drum indexes and also bulk density should give better correlation. Results of a statistical study at the Workington (England) furnace showed that best correlation was obtained with the minus ½-in. shatter and the corrected coke consumption per ton of iron.

O. P. Brysch

Corrosion

Henderson, D. BACTERIOLOGY IN THE GAS INDUSTRY. *Gas World* (British) **130**, 1477-1481 (1949) *September* 10.

Problems associated with bacterial action occurring at the Brisbane (Australia) Gas Company, Newstead Works are treated generally, grouped by the activities in the distribution mains, storage holders and works apparatus. Individual species of organism and concentrations are not given, but the anaerobic spirillae and vibrios are mentioned as causing corrosion of mains in water-logged soils. In water-sealed holders, tests indicated that bacteria can generate hydrogen sulfide from the organic sulfur compounds dissolved by the water from the stored gas. The disappearance of dissolved sulfates shows this also to be a possible source of H_2S. Tests of a transparent, jelly-like fungus in

holder water, when poisoned by added carbon disulfide, indicated that the dead organism yields hydrogen sulfide. In the gas works apparatus, the water in the station meter and Whessoe ammonia scrubber contained bacteria which could decompose carbon disulfide rapidly enough to give a H_2S stain with lead acetate paper. Addition of mercuric chloride (1 part /37 million) sterilized the water, but make-up water re-infected the apparatus.

O. P. Brysch

Distribution

MacLean, A. D. THE CAPACITY OF BALANCED VALVE REGULATORS. *Gas* 25, 34-41 (1949) *October.*

When a gas pressure regulator to apply to specified conditions of outlet pressure, minimum inlet pressure and maximum flow rate is selected, the manufacturer usually recommends that his published data be multiplied by a factor of one-half or one-third. This factor is necessary because the regulator performance in maintaining the outlet pressure constant was not recognized as a contributing factor in determining capacities. For weight and lever type regulators there is a distinct fall-off in controlled outlet pressure as the valve moves from the closed to open position. Thus for a specified control band the full capacity of the valve cannot be used. Results of the experimental determinations of the controlled pressure versus valve stem movement for several valve sizes are presented. A graph is presented from which the capacity modification factor for lever and weight regulators can be estimated from the maximum permissible outlet pressure and the permissible control band. With pilot loaded regulators and those controlled by instruments there is no need for a capacity modification factor.

O. T. Bloomer

Thomas, H. E. and Peacock, P. E., Jr. TRUE PICTURE OF UNACCOUNTED-FOR GAS SHOWN BY LINE LOSS STUDIES. *Am. Gas J.* 171, 20-21, 56 (1949) *October.*

The authors illustrate the misconceptions that can result when line losses are expressed as per cent of total sendout rather than as Mcf loss per mile of main per year. This is particularly true when the total sendout has been greatly increased, since the total gas losses may increase appreciably yet the unaccounted-for gas will only show a small percentage change. Results of a survey show that in the central and eastern states (except New England) the line losses in manufactured gas properties are greater per mile of main than in the LP gas properties. Recommendations are made for reducing these losses in order to obtain beneficial financial results.

E. F. Davis

Gas Plant

Young, J. W. ONE THING LEADS TO ANOTHER. Gas J. (British) 259, 655-662, 667 (1949) *September* 14.

Several ingenious devices to increase gas plant efficiency are described. Installation of pilot controller, actuated by pressure in collector main, automatically changed the weight loading of the standard counterbalanced bell governor, and maintained constant pressure conditions within the retorts. Calorific value control was unsatisfactory due to a time lag of 30 minutes or more in the calorimeter. A flat flame burner, fed by washed gas from the suction main, was found to be helpful in making preliminary adjustments for quality control. Also described is a controller for admitting air to the gas on the suction side of the exhauster.

W. E. Ball

Gasification

King, J. G. WILLIAM YOUNG MEMORIAL LECTURE: "BUT THEY WERE NOT DISCOURAGED." PART I. THE COMPLETE GASIFICATION OF WEAKLY-CAKING COALS. *Gas World* (British) 130, 1561-1568 (1949) *September* 24.

The extensive developmental and practical scale work on the Lurgi and similar "fluidization" and vortex methods of complete gasification is cited by the author as the necessary and beneficial bridge between the research worker and the practical man. Modifications involving gas pressure, use of oxygen, slag formation, methane synthesis, and heat loss have been re-

ported for various scales of development work carried on concurrently with fundamental research. The influence of scale factors and fundamental research has been mutually helpful in furthering practical solutions of difficulties in applying such a process to British coals. Large scale development of a plant for fluidization and methane synthesis seems to be the next step.

O. P. Brysch

King, J. G. "BUT THEY WERE NOT DISCOURAGED." PART II. COAL RESEARCH IN THE MECHANISM OF COKE FORMATION. *Gas World* (British) **130**, 1605-1610 (1949) *October* 1.

Coal research methods have failed to explain the caking property of coals. In the great volume of coal research work this very important gap remains, which has forced the technologist to rely on empirical methods. In chemical investigations, the separation and identification of soluble "coking" constituents has not been strictly coordinated among different workers. However, the author's early work on progressive hydrogenation of non-caking coals under pressure at 350°C to yield highly caking "coals" now appears to be worth development in view of the increased value and scarcity of good Scottish and English coals. Among results of physical investigations, the fact that the curve of coal porosity vs. coal rank passes through a minimum value at a rank at which caking power passes through a maximum has suggested a possible physical explanation of coke formation based upon internal pressure and plastic flow. However, coking of coal-inert blends does not support this explanation. Additions of initial decomposition products, or of inorganic chemicals has indicated that the condition of the decomposing coal surface is of importance. Here evolution of carbon dioxide appears to be significant. Seyler's differentiation of 10 coal components which increase in *reflectance of light* in a abrupt step-wise manner from lignite to anthracite has been found useful in showing changes in caking power with change in the amount of "coking reflecting component." Riley's X-ray studies of cokes from typical coals have given partial explanations of coking power as related to the crystallite dimensions of cokes, and solvent extraction and oxidation of coals. Coordination of the more promising methods, and further inspiration to the fundamental research worker by some partial development work and application of these methods, are justified by the present importance of coal.

O. P. Brysch

Heats of Wetting

Dresel, E. M. THE SIGNIFICANCE OF THE HEATS OF WETTING OF COAL POWDERS GROUND TO VARIOUS DEGREES OF FINENESS. *Fuel* (British) 193-199 (1949) *September.*

Mild grinding to pass 240 B.S.S. does not produce an appreciable amount of new surface, whereas drastic grinding (100 hrs.) produces fresh internal and external surface. Routine calorimetric measurement of the heat of wetting of coals in methyl alcohol gives approximately the true values with 240 B.S.S. size. With coarser powders the heat is less, depending upon the accessibility of the internal structure, with coking coals showing the least accessibility. Between the latter coals and the extreme types of bituminous rank, the accessible internal surface (for a given size fraction) can vary as 80 to 1. Depending on the depth of penetration, which is characteristic for a given coal, reduction in particle size will cause a reduction in this ratio of surface to a value of 4 to 1.

O. P. Brysch

Oil Gas

Pettyjohn, E. S. and Linden, H. R. ESTIMATED POTENTIAL GASIFICATION VALUE AND YIELDS OF OILS FOR GAS PLANTS. *Am. Gas J.* **171**, 26-31, 57 (1949) *October.*

Correlations of the enriching value (Btu recovery in the finished make gas) and the gaseous hydrocarbon and tar plus carbon yields with the carbon-hydrogen ratio of oils, the partial pressure of the oil gas in the cracking zone and the relative quantities of base gas hydrogen and oil introduced into the cracking zone are presented. Originally developed from laboratory cracking tests for a cracking temperature of 1550°F and 2.5 seconds residence time, these

correlations are also applicable with considerable accuracy over the temperature and residence time ranges used in the manufacture of carburetted water gas and high Btu oil gas. Methods for estimating the C/H ratio from various groups of physical tests are reviewed. Approximation of the other required operating variables from steam data for carburetted water gas and high Btu oil gas manufacture are discussed. Comparisons between actual and estimated cracking results are given. Applicability to pilot plant and laboratory cracking tube data for a range of feed stocks from propane to Bunker C fuel oil is demonstrated.

Authors' abstract

Stookey, K. W. THE MANUFACTURE OF OIL GASES FOR FUEL. PART I. *Gas Age* **103**, 11-14, 54, 56 (1949) *September* 1; PART II. *ibid.* 36-40, 64 (1949) *September* 15.

This article is a comprehensive review of the development of the high Btu oil gas process. The present status of the process is discussed in detail and summaries of recent operating experience with twin generator, single generator and Hall regenerative sets are presented. Problems of oil supply, oil quality and the production of oil gases substitutable or partially substitutable with natural gas are also discussed. A bibliography of 28 references is included.

H. R. Linden

Peak Load

Hall, Edwin L. PEAK LOAD GAS. *Gas Age* **104**, 23-24, 58, 60 (1949) *September* 29.

Methods for producing peak load gas are analyzed concisely. It is pointed out that the cheapest and most practical method is to select and control the load wherever and whenever possible by judicious sales of summer and interruptible gas. To supply peak load gas in natural gas systems, methods now in use include underground storage, pipeline and bottle storage, LP-air gas and high Btu oil gas. Methods for producing a natural gas substitute which may be employed but are not now in use include catalytic cracking of hydrocarbons, liquefaction and adsorption. In manufactured gas companies, the distribution systems are becoming the bottleneck of the system and many companies are proposing to increase the stated thermal contents of their gases by 10 to 25%. The experiences at Cambridge in going from 528 to 951 Btu gas and at Framingham in changing from 528 to 660 Btu are cited specifically. Need for methods of predicting interchangeability of gases is stressed.

C. H. Riesz

Pyridine Recovery

Ashmore, S. A. and Thickins, D. PYRIDINE FROM AMMONIA RECOVERY PLANTS. *Coke & Gas* (British) **11**, 307-308 (1949) *September.*

The experimental work described was undertaken in order to investigate the possibilities of pyridine recovery from saturator liquor and exit gases, these processes not being used in English plants at present. Analysis of samples of saturator liquor from 14 plants using the semi-direct method for ammonia recovery showed the content of pyridine bases to vary from 0.4 to 7.7% by weight. Analysis of the exit gases revealed that the alkalinity was mainly due to pyridine lost from the saturator, the amount of loss depending presumably upon degree of acidity and temperature. The authors conclude that supplies of pyridine and its homologs may be greatly augmented by utilizing these sources. A method of analysis for pyridine using a double indicator is given.

W. E. Ball

Smoke

Cosby, W. T. SMOKE. *Bull. Brit. Coal Utilization Research Assoc.* **13**, 225-231 (1949) *July.*

Recent contributions to an understanding of the formation and physical and chemical properties of smokes are reviewed. The topics considered are: the chemical composition and physical nature of smokes, the methods of measurement and the general factors influencing smoke emission, the formation of carbon in flames, the types of carbon, and the combustion of distillation smokes. 29 references are given.

A. J. Rudnitzki

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Lees, B. PARTICLE SIZE DISTRIBUTION OF THE DUST IN PRODUCER GAS. p. 275.

INTERCHANGEABILITY OF OTHER FUEL GASES WITH CARBURETTED WATER GASES. p. 259.

INTERCHANGEABILITY OF OTHER FUEL GASES WITH A MIXED COKE OVEN-CARBURETTED WATER GAS. p. 259.

INTERCHANGEABILITY OF CARBURETTED WATER GASES WITH A MIXED NATURAL GAS-BLUE GAS-CRACKED NATURAL GAS-PRODUCER GAS. p. 259.

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Corrosion

Eilerts, C. K., Smith, R. V., Archer, F. G., Burman, L. M., Greene, F. and Hamontre, H. C. FIELD AND LABORATORY TESTS OF SODIUM CHROMATES AND ALKALIES FOR CONTROLLING CORROSION IN GAS CONDENSATE WELLS. PART IV. TESTS OF MIXTURES OF SODIUM CHROMATE AND SODIUM HYDROXIDE. *World Oil* **129**, 174, 176, 178, 180 (1949) *October.*

The results of several tests studying the effect of variations of pH of mixtures of sodium chromates and sodium hydroxide on the reduction of chromates are reported. These mixtures gave substantially complete corrosion control and constant tubing flow capacities. Neither the use of small amounts of chromates nor the use of large volumes of water produced either exceedingly harmful or beneficial results. Dichromates gave complete corrosion control with decreasing flow capacity since they are more susceptible to reduction. Aqueous solutions of sodium hydroxide may be used to remove tubing deposits without sacrifice of corrosion control. There is no evidence present which indicates obstruction of the producing formation by reduced chromate deposit.

B. E. Hunt

LP Gas

Clifford, E. A. A PRACTICAL GUIDE TO LP-GAS UTILIZATION. PART VI. GAS PIPING. *LP-Gas* **9**, 44-48, 50, 52, 54, 56, 58 (1949) *September.*

This chapter describes the various types of tubes and pipe suitable for use as LP-gas piping. Methods for planning, installing and testing the pipe according to instructions in the National Board of Fire Underwriters pamphlets numbers 54 and 58 are discussed in detail.

E. F. Davis

Clifford, E. A. A PRACTICAL GUIDE TO LP-GAS UTILIZATION. PART VII. PIPE SIZING. *LP-Gas* **9**, 82-91 (1949) *October.*

Nomographs, charts and tables are used to select the proper pipe size for both high and low pressure LP-gas installations.

E. F. Davis

Pipe Lines

Bullock, R. L. MITIGATION OF CORROSION OF BARE PIPE LINES BY APPLICATION OF MAGNESIUM ANODES. *Oil Gas J.* **48**, 267-268, 271-272 (1949) *October* 6.

A new development in the protection of old bare pipe lines by the use of galvanic magnesium anodes is described. The method consists of locating the localized "hot spots" and then placing a sufficient number of anodes at these points to protect the pipe.

B. E. Hunt

Cahill, J. L. MAINTENANCE OF PIPE LINE ENGINES. *Oil Gas J.* **48**, 282, 284 (1949) *October* 6.

A four-point check system to reduce the most common pipe-line engine maintenance problems is proposed. The four points are: (1) engine lubrication system; (2) engine cooling system; (3) automatic control equipment; and (4) engine tuneup and accessory lubrication. The four points are discussed briefly.

O. T. Bloomer

Hofsess, R. W. CITIES SERVICE SMOOTH BENDS IN 26 IN. HIGH-CARBON THIN-

WALL PIPE. *Oil Gas J.* 48, 286-288, 291 (1949) *October* 6.

Results of yard tests of a hydraulically operated machine for making smooth bends in thin-wall high carbon steel pipe used in high pressure gas lines are described. The machine can be used on lines up to 30 in. O.D. The tests showed that wrinkle free bends of 1° per ft. of pipe could be made with little or no change in the pipe thickness at the outside of the bend and a slight increase in pipe thickness on the inside of the bend.

O. T. Bloomer

Miller, B. HOW THICK SHOULD LINE PIPE BE? *Oil Gas J.* 48, 240, 243, 247-248, 251, 254-256, 260 (1949) *October* 6.

The author discusses the various types of stress to which line pipe is subjected in practice. He proposes that less caution in selection of factors of safety is required now than in the past due to greater knowledge and experience. He also suggests specifying higher strength steel with less tolerance on wall thickness.

J. D. Parent

Polley, A. B. FIELD RECONDITIONING OF A LARGE DIAMETER PIPELINE. *Gas* 25, 101-102, 104 (1949) *September.*

In the last five years 56 miles of the Pacific Lighting Corporation's 26 in. Kettleman Hills-Long Beach, California pipeline (installed in 1931) have been removed from the ground and field reconditioned. A thorough description of the operation is given which included grading, ditching, raising, cleaning, sandblasting, spot welding of pitted areas or replacement of pipe, priming, wrapping, and reinstallation of the line. The cost per foot was $3.42 and a breakdown is given. It is concluded that "over the ditch" reconditioning is more economical than plant reconditioning if the pipe line does not require a high percentage of pipe replacements and if the existing circumferential welds do not require removal and rewelding.

O. T. Bloomer

Ricketts, R. D. DESIGN AND CONSTRUCTION OF TRANSCONTINENTAL'S SYSTEMS — LARGEST ARTERY OF THE NATURAL-GAS INDUSTRY. *Oil Gas J.* 48, 182-184, 315-319 (1949) *October* 6.

General design conditions for the Transcontinental line are given in some detail.

J. D. Parent

Stearns, D. E., Belson, M. W. and Lee, R. H. TECHNICAL FACTORS IN TESTING PIPE LINE COATINGS. *Corrosion* 5, 342-346 (1949) *October.*

The authors discuss three methods whereby the minimum voltage may be provided which will permit an adequate inspection of a pipe line coating. Tests are described in which the minimum voltage required to break down a coating is actually determined for a pulsating voltage form and for a 60 cycle sine wave form.

B. E. Hunt

Stephens, D. K. METHODS FOR ATTAINING HIGH NATURAL-GAS THROUGHPUT BY MAINTAINING CLEAN PIPE LINES. *Oil Gas J.* 48, 225-226, 325 (1949) *October* 6.

A very effective new type of pig is described. It is flexible and expansible so that scrapers are always pressed against the walls even as wear takes place. It also easily passes bends.

J. D. Parent

Thompson, F. W. EFFECT OF GRAVITY LOADS ON HIGH-PRESSURE PIPE LINES. *Oil Gas J.* 48, 81-82, 84, 89, 90 (1949) *October* 13.

Certain intervenors objected to the construction of the Michigan-Wisconsin pipe line across their farms fearing that the combination of internal gas pressure and the pressure and impact due to crossing by farm equipment would make the line unsafe. Lack of positive data on the effect of combined stresses led the Michigan Public Service Commission to request practical tests. A testing program was carried out, and it was shown that maximum pipe wall stresses did not exceed hoop stresses by more than 3,000 psi under conditions which were substantially more severe than any likely to be encountered in actual operations.

J. D. Parent

Production

Bankhead, C. C., Jr. APPLICATION AND EFFICIENCY OF GAS-LIFT. *World Oil* **129**, 160-162 (1949) *October.*

General types of gas lift equipment are described, and the application of these devices to oil production is briefly discussed.

O. T. Bloomer

Goldblatt, S. and Nelly, H. M., Jr. RICH-OIL STABILIZATION. *Oil Gas J.* **48**, 54-56, 82 (1949) *September* 29.

Advantages of rich oil deethanization or stabilization are; decreased load on still and fractionators, complete condensation of still overhead, and elimination of deethanizer. This is said to lead to decreased initial and operating costs. Several types of systems are explained and an elementary design procedure is given.

J. D. Parent

McCaslin, L. S., Jr. 7,900 PSI WELL. *Oil Gas J.* **48**, 68, 70, 72-73 (1949) *September* 29.

A high pressure well is producing about 7,500 Mcf per day of gas and 65 bbls. of oil with a tubing pressure of 7,900 psi.

J. D. Parent

Specific Heats

Buthod, P. SPECIFIC HEATS OF NATURAL GASES. *Oil Gas J.* **48**, 60, 64 (1949) *September* 29.

Specific heats are given for natural gases of specific gravity ranging from 0.55 to 0.9 in the pressure range of atmospheric to 5,000 psia and in the temperature range of 0 to 1000°F. High accuracy is not claimed.

J. D. Parent

Storage

Parker, P. A SUMMARY OF COSTS AND PROBLEMS IN STORING BTU's. Paper presented at the American Gas Association Technical Section, October 17-20, 1949.

The author presents data on the costs of meeting peak loads by various means. This is all tabulated in compact form under the headings of total investment cost per Mcf stored, total annual cost per Mcf handled, and type of application economically possible.

J. D. Parent

THE CHICAGO LIQUEFACTION AND STORAGE PLAN. *Gas* **25**, 92-100 (1949) *October.*

The plan for a liquefaction plant is discussed. The liquefaction rate would be 4 MMcf per day while the regasification rate would be 6 MMcf per hr. Storage equipment would consist of six insulated holders of 67 MMcf capacity each. Considerable structural information is presented on the design of storage vessels. An itemized investment cost is presented. The total investment would be $6,000,000.

J. D. Parent

Transmission

Owen, H. C., Jr. COMPRESSOR CALCULATIONS AS APPLIED TO THE TRANSMISSION OF NATURAL GAS. *Oil Gas J.* **48**, 112-114, 117-118, 120, 122 (1949) *October* 20.

Based on new relations for the isentropic behavior of non-ideal gases, expressions are developed for volumetric efficiency and theoretical isentropic compressional horse-power for reciprocating compressors. Certain simplifying assumptions are involved. The author feels his procedure is rapid and quite accurate.

J. D. Parent

Abstractor's Note. The new P-V-T relations for actual gases undergoing isentropic change which are the bases for this work, have been presented without reference to origin. These are original to the abstractor who has presented them in class at the Institute of Gas Technology for several years. Unfortunately, the new equations are not without limitation. Although they are somewhat superior to the ideal gas law forms, they only apply for a condition which is satisfied when relatively ideal behavior is exhibited. They apply quite accurately for nitrogen and air up to about 1,000 psi but only up to about 300 psi for natural gases.

Scarth, V. (assigned to Phillips Petroleum Company) PIPE LINE TRANSPORTATION OF FINE SOLIDS. U.S. 2,478,326 (1949) August 9.

An object of the invention is the transportation of carbon black or other fine solids in pipe

lines. A special method of preventing caking of solids is claimed.

J. D. Parent

Van Wingen, N. PRESSURE DROP FOR OIL-GAS MIXTURES IN HORIZONTAL FLOW LINES. *World Oil* 129, 156-158 (1949) *October.*

Pressure drop data for flow of oil and gas mixtures were checked against values predicted on the basis of the two phase friction correlations of Martinelli et al. Trends agree well. At low rates of gas flow observed drops exceed those predicted but not greatly.

J. D. Parent

Wolfe, O. THE ROUGHNESS PROBLEM WITH RESPECT TO FLOW THROUGH COMMERCIAL STEEL PIPE AND THE DIRECT SOLUTION OF THE FANNING EQUATION FOR EITHER THE FLOW RATE OR DIAMETER. *Oil Gas J.* 48, 189, 191-192, 195, 322 (1949) *October* 6.

Charts for pressure drop calculations are presented. In addition to the usual type there is one in which a friction factor is plotted against a modified Reynolds number based on friction velocity and another in which Reynolds number is plotted against a diameter function. These latter charts are intended to permit rapid solution of problems for velocity and diameter without trial and error procedure.

J. D. Parent

Wolfe, O. THE ROUGHNESS PROBLEM. *Oil Gas J.* 48, 91-95 (1949) *October* 13.

The effect of wall roughness and Reynolds number on friction and flow pattern is discussed.

J. D. Parent

Wolfe, O. THE ROUGHNESS PROBLEM. *Oil Gas J.* 48, 94-95, 121-122 (1949) *October* 20.

A discussion of friction factor for flow in the transition and wholly rough regimes is presented in terms of the most modern analyses.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Hall, E. J. PEAK LOAD GAS. p. 267.

Hoxeng, R. B. and Prutton, C. F. ELECTROCHEMICAL BEHAVIOR OF ZINC AND STEEL IN AQUEOUS MEDIA. p. 280.

Loughry, T. F. ECONOMICS OF CATALYTIC GAS CRACKING APPLIED TO EASTERN NATURAL GAS. p. 263.

MacLean, A. D. THE CAPACITY OF BALANCED VALVE REGULATORS. p. 265.

Szitar, J. DOMESTIC INSTALLATIONS—7 SAFE STEPS. PART II. p. 260.

Thomas, H. E. and Peacock, P. E., Jr. TRUE PICTURE OF UNACCOUNTED-FOR GAS SHOWN BY LINE LOSS STUDIES. p. 265.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Coal Hydrogenation

Pelipetz, M. G., Kuhn, E. M., Friedman, S. and Storch, H. H. STUDIES OF THE KINETICS OF COAL HYDROGENATION. U.S. Bureau of Mines Report of Investigation 4546 (1949) September.

Data from autoclave experiments provides information regarding the effects of vehicle, temperature, pressure and time upon the nature of the products from the hydrogenation of Pittsburgh-bed coal. A comprehensive evaluation is deferred to a later publication.

C. H. Riesz

Fischer-Tropsch Synthesis

Anderson, R. B., Kreig, A. and Friedel, R. A. FISCHER-TROPSCH SYNTHESIS. *Ind. Eng. Chem.* 41, 2189-2197 (1949) *October.*

At atmospheric presure, the course of Fischer-Tropsch synthesis in a bed of cobalt catalyst was followed by means of a special sampling device. A small amount (5%) of argon added to the synthesis gas served as a reference material and permitted computation of the amounts of all constituents at any sampling

point. The synthesis rate was high in the initial part of the bed, lower and nearly constant throughout a large portion of the catalyst bed until one or both of the reactants was substantially consumed. Methane and carbon dioxide were formed by primary reactions. Methane was also formed by secondary hydrogenolysis of higher hydrocarbons and carbon dioxide by the water gas reaction. These reactions are a function of the gas composition in contact with the catalyst and temperature.

C. H. Riesz

Barr, F. T. and Scharmann, W. G. (assigned to Standard Oil Development Co.) TWO-STAGE SYNTHESIS OF HYDROCARBONS. U. S. Re 23,145 (1949) September 6.

The synthesis of hydrocarbons from carbon monoxide and hydrogen is conducted in two separate reactors. The first reactor utilizes a fluidized catalyst and effects a conversion of not more than 60% of that possible; the second reactor employs a fixed catalyst bed and produces a maximum yield of normally liquid products.

C. H. Riesz

Holder, C. H. (assigned to Standard Oil Development Co.) TWO-STAGE PROCESS FOR THE SYNTHESIS OF HYDROCARBONS. U.S. 2,483,711 (1949) October 4.

In the synthesis of higher hydrocarbons from carbon monoxide and hydrogen, the synthesis gas passes first through a fluidized catalyst reactor and then through a liquid dispersed catalyst reactor, the catalyst for the second reactor being recovered by oil scrubbing the effluent stream from the fluidized reactor.

C. H. Riesz

Michael, V. F. and Phinney, J. A. (assigned to Stanolind Oil and Gas Co.) PRODUCTION OF OXYGENATED COMPOUNDS AND LIQUID HYDROCARBONS FROM HYDROCARBON GASES. U.S. 2,482,284 (1949) September 20.

In the conversion of natural gas hydrocarbons into gasoline by means of the Fischer-Tropsch process, a primary oxidation produces oxygenated compounds and oxidizes sulfur into a form removable by water scrubbing. The gas from the oxidation step, after conversion into synthesis gas, is synthesized into gasoline and associated hydrocarbons. The aqueous layer containing oxygen compounds is combined with scrubber solution for further processing.

C. H. Riesz

Gas Synthesis Plant

SYNTHETIC LIQUID FUELS PRODUCED FROM COAL IN GOVERNMENT DEMONSTRATION PLANTS. PART II. GAS- SYNTHESIS PLANT. *Ind. Heating* **16**, 1546-1548, 1550, 1552, 1554, 1556 (1949) *September.*

The synthesis gas plant at Louisiana, Mo., is described.

C. H. Riesz

Internal Combustion Engine

Ruble, R. J. (assigned to Texaco Development Corp.) PREPARATION OF GAS MIXTURES. U.S. 2,484,249 (1949) October 11.

Gas mixtures comprising carbon monoxide and hydrogen are produced by the partial combustion of a hydrocarbon (such as natural gas) with high purity oxygen (e. g. 90%) in an internal combustion engine of special design.

C. H. Riesz

Petrochemicals

Perry, C. W. EVOLUTION OF THE PETROCHEMICAL INDUSTRY. *Oil Gas J.* **48**, 66-67, 82, 84, 87-88 (1949) *September* 29.

The production of petrochemicals from various hydrocarbon sources is considered.

C. H. Riesz

Petroleum Processing

CATALYTIC CRACKING AND REFORMING PROCESSES. *Petroleum Refiner* **28**, 160-161, 166-167, 170-171, 174-175, 178-179, 182-183 (1949) *September;* GAS CONVERSION PROCESSES. *ibid*, 184, 189, 192-193, 196-197, 200-201, 204-205, 208-209; PETROCHEMICAL PROCESSES. *ibid* 298-299, 302-303, 306-307, 310-311, 314-315, 318-319, 321.

Salient features of various petroleum industry processes are reviewed in this annual process

section. Of possible interest to the gas industry are the processes grouped under "Catalytic Cracking and Reforming," "Gas Conversion," and "Petrochemical Processes."

C. H. Riesz

Purification

Johnson, A. B. and Higgins, J. T. (assigned to California Research Corporation) PURIFICATION OF CARBONYL SULFIDE CONTAMINATED HYDROCARBON GASES. U.S. 2,484,381 (1949) October 11.

Carbonyl sulfide contained in a gaseous mixture consisting mainly of propane and propylene is removed by adding these gases to a stream of naphtha undergoing hydroforming. As examples, data obtained in a commercial unit are cited. Propane containing 700 parts per million by weight of sulfur as carbonyl sulfide was converted to a product containing less than 0.04 parts per million. Simultaneously, the propylene content was substantially eliminated.

C. H. Riesz

Liquid Fuels

Golumbic, N., Anderson, H. C. and Grass, R. C. REVISED BIBLIOGRAPHY OF BUREAU OF MINES INVESTIGATIONS ON THE PRODUCTION OF LIQUID FUELS FROM OIL SHALE, COAL, LIGNITE, AND NATURAL GAS (TO 1949). U.S. Bureau of Mines Information Circular 7534 (1949) September.

This bibliography contains those papers previously listed in Information Circular 7304 plus additional items intended to make the bibliography as complete as possible up to the date of issue. In addition to the publications issued by the Government in printed or mimeographed form, references are included to articles written by the Bureau staff for the technical press and to cooperative reports of work done jointly with states, colleges, and industries. References are given under each section by years in chronological order, and the items in each year are arranged in alphabetical order. 736 references are included.

Excerpt from paper.

Thermal Reforming

Feuchter, C. F. ECONOMICS OF THERMAL REFORMING. *Chem. Eng. Progress* 45, 644-648 (1949) *October.*

The economics of thermal reforming of straight-run gasoline to increase octane number has been studied. It is indicated that, at the present price structure, the savings are small being about 1 cent per bbl at optimum conditions. Octane requirements have a relatively large effect on the economics and it may be necessary to reform thermally regardless of cost in order not to exceed the maximum allowable tetraethyl lead content of 3.0 cc/gal. Other variables and economic factors are discussed.

C. H. Riesz

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Sands, A. E., Grafius, M. A., Wainwright, H. W. and Wilson, M. W. THE DETERMINATION OF LOW CONCENTRATIONS OF HYDROGEN SULFIDE IN GAS BY THE METHYLENE BLUE METHOD. p. 274.

7. ANALYTICAL METHODS AND TESTS

Carbon and Hydrogen

Lescher, V. L. DETERMINATION OF CARBON AND HYDROGEN BY COMBUSTION. *Anal. Chem.* 21, 1246-1249 (1949) *October.*

A simplified rapid method for the routine semimicrodetermination of carbon and hydrogen is presented. Liquid samples are slowly vaporized, and the vapors are burned in a flame at the tip of the containing ampoule. Combustion is supported by a stream of oxygen at a very high flow rate. A technique for handling solid samples is also presented, by which two sets of apparatus can be operated simultaneously, thereby allowing six to eight determinations per day; explosion hazards are diminished; and a shorter training period for new analysts is required.

Author's abstract

Fractional Distillation

Starr, C. E., Jr., Anderson, J. S. and Davidson, V. M. LABORATORY LOW TEMPERATURE FRACTIONAL DISTILLATION. *Anal. Chem.* 21, 1197-1200 (1949) *October.*

This work studies the optimum distillation rates and fraction cut points for a low temperature fractional distillation employing a Podbielniak Hyd-Robot distillation apparatus. Gas sample 1 was a product gas stream consisting of noncondensables, and C_1, C_2, C_3, C_4 and C_5 hydrocarbons from a fluid catalyst cracking unit; and sample 2 was a gas similar to sample 1 with only a trace of the C_3 fraction. The samples were charged and refluxed in the usual manner, the distillations were made at several different rates, and the heart cuts were analyzed by a mass spectrometer. Also analyses were made of the total major fractions and fractions taken between major boiling points. In general, the major portion of the contamination, which is negligible, is due to the lower boiling components. The study proved that the effect of the distillation rate on the amount of contamination shows no trend and the highest rate of 100 cc per min. may be employed without loss in accuracy. The cut points between fractions could be raised over those previously stipulated to enhance accuracy.

M. C. Miyaji

Gas Analysis

Brooks, F. R., Lykken, L., Milligan, W. B., Nebeker, H. R. and Zahn, V. ANALYSIS OF GASES BY ABSORPTION AND COMBUSTION. *Anal. Chem.* 21, 1105-1116 (1949) *September.*

Improved gas analysis apparatus and methods developed over a ten year period are described in detail. Features of the apparatus include a mercury lift to control and direct the flow of gas in the apparatus, a special manifold support for clamping the barrel of each stopcock to the analyzer frame, connections made with glass ball and socket joints, a constant-pressure reservoir for confining gases over mercury during complete cycle passes, and construction in unit sections to permit assembly for specific requirements. Three analytical methods are given; the first combines absorption and combustion procedures for mixtures of fixed gases and hydrocarbons, the second employs only progressive absorption for mixtures of C_4 hydrocarbons, and the third also employs only progressive absorption for vaporized mixtures of C_5 hydrocarbons. Combustion of hydrogen in the first method is effected by passage over CuO wire 270°C and combustion of paraffins by passage over CuO containing 1% Fe_2O_3 at 700°C. Complete directions for preparing each of the various reagents used in the absorption procedures are presented along with instructions for using the reagents in each method of analysis. Schematic drawings of each portion of the apparatus and their assembly are shown. A bibliography consisting of 55 pertinent references is included.

H. Hakewill

Abstractor's Note: Anyone regularly doing gas analyses or contemplating work of this nature will find this article most informative and instructive. The authors have critically reviewed the apparatus described in the literature and that commercially available for gas analysis and have carefully and completely described methods of gas analysis employing known apparatus and procedure improved by refinements discovered in their own laboratory.

Hydrogen Sulfide

Sands, A. E., Grafius, M. A., Wainwright, H. W. and Wilson, M. W. THE DETERMINATION OF LOW CONCENTRATIONS OF HYDROGEN SULFIDE IN GAS BY THE METHYLENE BLUE METHOD. U.S. Bureau of Mines Report of Investigations 4547 (1949) September.

The Bureau of Mines at Morgantown, West Virginia has developed a colorimetric method for the determination of traces of H_2S in connection with their work on the production and purification of synthesis gas suitable for use in the Fischer-Tropsch synthesis of liquid fuels. The maximum concentration of sulfur that can be tolerated in this gas to avoid catalyst poisoning is 0.1 grain per 100 ft^3. Although the analytical procedure devised at Morgantown was

specifically designed for H_2S, organic sulfur compounds may be reduced and subsequently determined as H_2S. This paper does not describe the reduction step, but deals exclusively with the determination of H_2S by the photoelectric or spectrophotometric measurement of the quantity of light absorbed by solutions of methylene blue produced by the reaction of H_2S with p-aminodimethylaniline sulfate. Absorption measurements were made with a Klett-Summerson photoelectric colorimeter employing a No. 66 filter and also with a Beckman spectrophotometer at a wavelength of 745 millimicrons. It was found that the Lambert-Beer law applied over the range of H_2S concentrations investigated. Application of the method to synthetic CO-H_2 mixtures, coke oven gas, carburetted water gas, and blue water gas has indicated its suitability for these gases. It is claimed that mercaptans, carbon disulfide, and thiophene do not interfere with H_2S determination by this method. An acidified aqueous 2% zinc acetate solution is used for absorbing H_2S from the gas. When the volume of gas sample taken is one cu ft., a minimum of 0.001 grain of H_2S sulfur per 100 ft^3 can be detected with the methylene blue test. When 0.05 grain of H_2S-sulfur per 100 ft^3 is present in the gas, the volume of sample required for analysis is only one-tenth cu ft, and the result can be obtained in less than 30 minutes.

H. Hakewill

Abstractor's Note: The authors appear to have done a thorough job of checking the variables affecting the methylene blue method for H_2S determination and have developed a rapid, sensitive test procedure for traces of H_2S in gas streams.

Particle Size

Lees, B. PARTICLE SIZE DISTRIBUTION OF THE DUST IN PRODUCER GAS. *Fuel* (British) **28**, 208-213 (1949) *September.*

The particle size measurement of the dust in producer gas was carried out in three ways: (a) By sieving the dust and weighing the fractions. (b) By collecting the dust on a filter paper, and counting and measuring particles down to 4 microns diameter by means of a microscope. c) By allowing the dust to settle in a sedimentation cell, and counting and measuring the particles with a microscope. The apparatus and methods for determining the dust concentration and for making the particle size measurement of the dust are described. The results of particle size analysis were used to explain the occurrence of different types of dust obtained from the producer operating under various conditions, and to explain the variations in efficiency of a water washer. Chemical analysis of the dust showed that, under certain conditions, the very fine nature of the dust was due to sublimation of either silicon or sodium compounds from the producer fuel.

Author's abstract

Radiological Measurements

Brunner, E. M. (assigned to Shell Development Co.) METHOD AND APPARATUS FOR RADIOLOGICAL MEASUREMENTS. U.S. 2,476,810 (1949) July 19.

A procedure is described for the determination of hydrogen-containing liquids or gases, by the ability of hydrogen to slow down fast neutrons. The slow neutrons are absorbed by such metals as silver, indium, rhodium, manganese, etc. whose delayed emission of beta particles serve as an index of the degree of neutron slowing and hence of the hydrogen concentration. Gas pressures and liquid levels are mentioned as possible applications.

S. Katz

The following article, the abstract for which apears on the page indicated, is also called to your attention:

Berman, N. and Howard, H. C. WATER-SOLUBLE POLYCARBOXYLIC ACIDS FROM OXIDATION OF BITUMINOUS COAL. p. 264.

8. GENERAL AND PHYSICAL CHEMISTRY

Flame Stability

Thomas, N. STRUCTURE AND STABILITY OF BURNER FLAMES. *Trans. Faraday Soc.* (British) 45, 781-794 (1949) *August.*

A purely thermal theory of flame stability, based on a heat balance across the flame surface, is developed. The introduction of simplifying assumptions and the neglect of radiation and aerodynamic factors limit the rigorous application of the theory to non-turbulent flames of near-stoichiometric or lean composition. Flash-back and blow-off as aspects of flame instability and the propagation of flame in tubes are interpreted in the light of the thermal theory, and the experimental evidence of other investigators is discussed.

A. J. Rudnitzki

Thermodynamics

Edmister, W. C. APPLICATION OF THERMODYNAMICS TO HYDROCARBON PROCESSING. PART XXII. CONVERGENCE CORRECTION TO VAPOR-LIQUID EQUILIBRIUM RATIO. *Petroleum Refiner* 28, 95-102 (1949) *September.*

The convergence pressure of a liquid mixture is defined as the pressure at which the ratio of the vapor to liquid phase, K, is unity. This pressure is dependent on both the composition and the temperature of the system, and is of value in correcting the K values for the effect of high pressures. The procedure is largely empirical. A number of typical correlations are described, their limits of application are indicated and the need for the extension of the scope of these correlations is discussed.

S. Katz

Roegiers, M. VAPOR PRESSURE, SURFACE TENSION, VISCOSITY AND EQUILIBRIUM PROPORTIONS OF IDEAL MIXTURES (1). *Petroleum* (British) 12, 256-258 (1949) *October.*

An extension of the law of corresponding states is used to develop equations for the determination of vapor pressures, liquid and gaseous viscosities, surface tensions, and the liquid-vapor phase distributions for ideal binary systems.

S. Katz

The following articles, the abstracts for which apear on the pages indicated, are also called to your attention:

Barr, J. COMBUSTION IN VITIATED ATMOSPHERES. p. 261.

Buthod, P. SPECIFIC HEATS OF NATURAL GASES. p. 270.

Dresel, E. M. THE SIGNIFICANCE OF THE HEATS OF WETTING OF COAL POWDERS GROUND TO VARIOUS DEGREES OF FINENESS. p. 266.

10. CHEMICAL ENGINEERING

Distillation

Atkins, G. T. and Boyer, C. M. APPLICATION OF MC CABE-THIELE METHOD TO EXTRACTIVE DISTILLATION CALCULATIONS. *Chem. Eng. Progress* 45, 553-562 (1949) *September.*

This method has been successfully applied to (1) a study of operating variables which has led to maximum recovery of butylenes in the present system, (2) determination of plate efficiency in the extractive distillation tower, (3) determination of the butylene recovery from a variety of new feed stocks proposed for processing, and (4) has served as a basis for the design of an additional extractive distillation tower which was installed to increase the butylene recovery capacity of the feed preparation system.

Excerpt from authors' abstract

Underwood, A. J. V. FRACTIONAL DISTILLATION OF MULTICOMPONENT MIXTURES. A NUMERICAL EXAMPLE. *Chem. Eng. Progress* 45, 609-618 (1949) *October.*

The new Underwood procedure for multicomponent distillation calculations is applied to a system of 5 components. Ten pages, largely devoted to equations, are required.

J. D. Parent

Fluid Flow

Dotson, J. M., Holden, J. H., Seibert, C. B., Simons, H. P. and Schmidt, L. D. NEW METHOD MEASURES THE SOLID:GAS RATIO IN HIGH-SOLID FLOW. *Chem. Eng.* 56, 129-130 (1949) *October.*

An electronic device consisting of a condenser and special electronic circuit was developed for measuring the instantaneous solid to gas ratio in flowing suspensions. The solid-gas suspension is conducted through parallel aluminum plates acting as a condenser, the change of capacitance of which is measured by a sensitive inductively coupled resonating circuit connected to an oscilloscope. The gas to solid ratio is determined from a calibration of oscilloscope reading which is proportional to the change in dielectric constant of the flowing mixture.

C. Von Fredersdorff

Fractionators

Gelus, E., Marple, S., Jr., and Manning, E. J. TECHNIQUE OF PERFORMANCE STUDIES ON COMMERCIAL FRACTIONATORS. *Chem. Eng. Progress* 45, 602-608 (1949) *October.*

The authors state the procedure which they used in evaluating the efficiency of a fractionator for a complex mixture of hydrocarbons. The experimental value is 32-35% as compared to 45% predicted on the basis of the Geddes method and 58% predicted on the basis of the Drickamer and Bradford correlation. They feel that the latter is an over simplification since it has nothing related to design or loading.

J. D. Parent

Heat and Mass Transfer

Friedman, S. J. and Marshall, W. R., Jr. STUDIES IN ROTARY DRYING. PART II. HEAT AND MASS TRANSFER. *Chem. Eng. Progress* 45, 573-588 (1949) *September.*

The effects of the variables air rate, feed rate, rate of rotation, slope of dryer, and number of flights on heat transfer from air to sand has been studied in a rotary drier to gain better insight into design of this type of equipment. Tests were conducted primarily on heat transfer to dry sand in order to make it simpler to evaluate the effects of the operating variables, although drying tests were also made. The dryer was 1 ft by 6 ft, and measurements were made at 1 ft intervals along the axis. Four different sands were used in the tests. Effect of air rate was to vary V_a, B.t.u./ (hr x ft^3 x °F), according to the 0.16 power of mass velocity. Increasing feed rate increased V_a. Increasing the holdup increased V_a as a function of the 0.5 power of this variable. Rate of rotation appeared to have little effect on the coefficient. Decreasing slope increased the holdup, which increased V_a until a critical value of 3% holdup was reached, above which no further increase in V_a was observed. However, increase in holdup caused by increased air or feed rate was effective in increasing V_a to 8% of drier volume. Good agreement between heat transfer and drying data was obtained. Values of V_a varied in the range 15-25. A method of estimating performance of large driers is suggested.

C. L. Tsaros

Kreith, F. and Summerfield, M. HEAT TRANSFER TO WATER AT HIGH FLUX DENSITIES WITH AND WITHOUT SURFACE BOILING. *Trans. Am. Soc. Mech. Engrs.* 71, 805-815 (1949) *October.*

Surface coefficients for heat transfer from electrically heated stainless-steel tubes to water were obtained for heat ransfer rates up to 3 Btu/sq. in.-sec. and mass flow rates up to 5.4 lb/sq. in.-sec. Boiling and non-boiling forced convection data were correlated by the Colburn equation $Nu = aRe^nPr^m$ where Re and Pr denote Reynolds and Prandtl number respectively and a, n and m are constants. Pressure drop with and without boiling heat transfer were related to an empirical viscosity correction factor. It was found that the heat transfer coefficient between metal wall and liquid in turbulent flow cannot be predicted by the Colburn equation when the surface temperature exceeds the boiling point of the solution; that the surface temperature required to transfer a given quantity of heat to a liquid when surface boiling occurs is primarily a function of the liquid pressure; and that the maximum rate at which a liquid at a given pressure can absorb heat is

limited by unstable flow phenomenon similar to cavitation in which case the vapor pressure of the liquid is in excess of the total pressure of the system. Heat transfer data at high transfer rates are useful in design of liquid-cooled rocket motors and in recent power-plant developments.

C. Von Fredersdorff

Leva, M., Weintraub, M. and Grummer, M. HEAT TRANSMISSION THROUGH FLUIDIZED BEDS OF FINE PARTICLES. *Chem. Eng. Progress* **45**, 563-572 (1949) *September.*

Heat transfer studies were made in fluidized beds, the source of heat being a steam jacket around the column. Three equations were developed to correlate the results and the terms of the equations involved the thermal conductivity, viscosity, mass velocity, and specific heat of the fluid. The bed height, bed density, particle density and vessel diameter were found to have no influence on the rate of heat transfer. The effect of slugging on heat transfer was negligible, but channeling had a pronounced effect.

W. J. Merwin

Mack, D. E. and Marriner, R. A. A METHOD OF CORRELATING AGITATOR PERFORMANCE. *Chem. Eng. Progress* **45**, 545-552 (1949) *September.*

In order to study agitator performance, the rate of mass transfer from solid particles of benzoic acid to a suspending dilute solution of sodium hydroxide was studied. Actual mass transfer coefficients were not calculated, the reciprocal of the time required for neutralization being used as the measure of transfer rate. The variables studied were: liquid depth and tank diameter, particle size, baffling and a dimensionless grouping of power, shaft speed, liquid density, and acceleration due to gravity. Particle size of the solid phase, in the range studied, was found not to be influential and size, number and positions of the baffles were found to have no effect so long as "fully baffled" conditions (defined elsewhere) were maintained. Tank size variation was less than twofold, and only radial flat-blade impellers were used. The determinant variables were grouped in a general correlation.

C. L. Tsaros

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Wolfe, O. THE ROUGHNESS PROBLEM. p. 271.

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Automatic Control

LaViolette, W. A. REMOTE CONTROL AND TELEMETERING. *Gas* **25**, 54, 56, 59-60, 62, 65 (1949) *September.*

The author briefly outlines the principles of operation of a transmitter and a receiver in the telemetering system and then shows how the single function telemetering system can be expanded to perform 14 separate functions. These include the use of recorders, indicators, remote positioning of valves, the use of alarms, signals, time delay relays and other devices. Nothing new is claimed, but what can be done with commercially available equipment is shown.

W. J. Merwin

Oppelt, W. FUNDAMENTALS OF AUTOMATIC CONTROL. *Engrs' Digest* **10**, 317-321 (1949) *September.*

This is the concluding article of an abstract of a book on automatic control. The various criteria for stability in four types of control systems are expressed mathematically in terms of differential equations. An illustrative example is presented.

W. J. Merwin

Pyle, C. CONTROL SYSTEMS FOR DISTILLATION TOWERS. *Oil Gas J.* **48**, 97-99, 102-103 (1949) *October* 13.

The elements susceptible to control in a fractionating tower are feed rate, condenser water rate, reboiler steam rate, and product quality. The author presents flow diagrams showing the various combinations of controls in common use and discusses their relative merits and limitations. The diagrams cover atmospheric, vacuum, and pressure operation.

W. J. Merwin

Heat-Exchange Equipment

John, A. THE MECHANICAL CLEANING OF FOULED HEAT-EXCHANGER TUBES. *Trans. Am. Soc. Mech. Engrs.* **71**, 825-829 (1949) *October.*

A direct drive air-operated mechanical tube cleaner is described. The rotary shaft is hollow and can be coupled in short lengths to permit tube cleaning in place or where quarters are cramped. The drill bits are of special alloy steel capable of sustained operations at 600 to 700°F. A scavenger such as air or water is always used to carry away the resultant scale chips. The author also describes an electrically driven cleaner and a standard turbine type for use with air, water, or steam. Best results are claimed when a regular cleaning program is followed.

W. G. Bair

Loucks, C. M. and Groom, C. H. CHEMICAL CLEANING OF HEAT EXCHANGE EQUIPMENT. *Trans. As. Soc. Mech. Engrs.* **71**, 831-836 (1949) *October.*

A prerequisite to good chemical cleaning is an analysis of the deposits so an intelligent choice of solvents can be made. For inorganic deposits inhibited HC1 is most often used. For organic deposits strong acid and alkali solutions are often used, or straight organic solvents such as $CC1_4$ find application. Good safety measures must be used with chemical cleaning since toxic gases are often liberated during the cleaning process, and corrosive liquids are generally used as solvents. The cost of chemical cleaning is largely the cost of the solvent used and in many cases is quite high. However, chemical cleaning does not require dismantling of the equipment and in many cases this is an important factor. Operating data on various types of heat exchangers before and after cleaning is given.

W. G. Bair

Weiland, J. H., Jr., McCay, R. C. and Barnes, J. E. RATES OF FOULING AND CLEANING OF UNFIRED HEAT-EXCHANGER EQUIPMENT. *Trans. Am. Soc. Mech. Engrs.* **71**, 849-853 (1949) *October.*

The author presents graphs and data on rates of fouling and decrease in over all heat transfer coefficient. As can be expected, as the fouling increases the over all coefficient drops. The data was collected from refinery applications of heat transfer equipment. Mechanical cleaning was used at regular intervals; in one installation an alkali wash was used on the shell side of an exchanger.

W. G. Bair

Instrumentation Symbols

Hostedler, D. E. INSTRUMENTATION FLOW-PLAN SYMBOLS. *Oil Gas J.* **48**, 80-84 (1949) *September* 15.

The author presents a list of letter combinations and flow plan symbols which are recommended as standard for instrumentation drawings. The process variables covered include temperature, flow, level, pressure, density, moisture, conductivity speed, viscosity, and weight.

W. J. Merwin

Pressure Vessels

Maccary, R. R. and Fey, R. F. DESIGN OF PRESTRESSED SHELLS FOR PRESSURE VESSELS. *Chem. Eng.* **56**, 105-107, 111 (1949) *September.*

The authors show mathematically that shell thickness can be reduced by as much as 40% in the case of thick cylinders if the vessel is prestressed. One method of prestressing is to utilize multi-shell construction, where each shell is shrunk on. In practice the use of more than two shells becomes uneconomical. Design charts for two shell prestressed construction are presented and it is concluded that built up construction possesses an economic advantage of smaller over-all outside diameter of shell when the internal pressure is about one-half the allowable working stress.

W. J. Merwin

Thermal Instrument

Hastings, C. E. VELOCITY AND FLOW MEASUREMENTS WITH AN IMPROVED THERMAL INSTRUMENT. *Science* **110**, 363-365 (1949) *October* 7.

This instrument consists of an electrically heated precious metal thermopile. When placed in an air stream there is a tendency to bring the thermopile wire to the same temperature throughout, thus reducing the temperature difference and consequently the emf generated by the thermopile. The change in voltage is indicated by a meter calibrated in terms of air velocity. Air velocities as low as 5 fpm are measurable as well as the usual wind velocities. This instrument is made by the Hastings Instrument Company.

W. J. Merwin

12. MATERIALS OF CONSTRUCTION

Corrosion

Hoxeng, R. B. and Prutton, C. F. ELECTROCHEMICAL BEHAVIOR OF ZINC AND STEEL IN AQUEOUS MEDIA. *Corrosion* **5**, 330-338 (1949) *October*.

The reversal of the zinc-steel couple was obtained under laboratory conditions when specimens were treated in various solutions at differing temperatures. The reversal of this couple was attributed to the change of potential of the zinc specimen which was dependent upon both the temperature and electrolyte composition. The electrolyte composition appeared to be the more important factor with the temperature becoming important in border-line cases. Of the variables studied in the presence of oxygen, sulfates and chlorides decrease while bicarbonates and nitrates increase the probability of reversal.

B. E. Hunt

LaQue, F. L. and Mogerman, W. D. NOTES ON GALVANIC CORROSION. *World Oil* **129**, 153-154, 158 (1949) *October*.

The authors discuss the theory of bimetallic corrosion and tabulate the relative intensities of corrosion of various metals used in combination in electrolytic solution. Single-metal construction is preferred but where bimetallic construction is required it is suggested that the exposed area of the least noble metal be greater than that of the nobler metal.

B. E. Hunt

Wyllie, D. and Cheesman, G. C. N. SODIUM NITRITE AS AN INHIBITOR AGAINST THE ATTACK OF SEA WATER ON STEEL. PART II. THE ADDITION OF OTHER INHIBITORS TO NITRITE. *J. Soc. Chem. Ind.* (British) **68**, 209-212 (1949) *July*.

The effect of mixing various inhibitors with sodium nitrite is described and the efficiency and probable mode of action of the individual inhibitors are discussed. The radicals studied were mostly those having insoluble ferric salts and reasonably soluble calcium and magnesium salts. These included phosphates, including metaphosphate, carbonate, sulfates and zinc salts. The addition of small amounts of mono- and dihydrogen phosphates and hexametaphosphate with small amounts of carbonate gave a high degree of protection to the steel.

B. E. Hunt

High-Pressure Equipment

Harding, A. G. CONSTRUCTION MATERIALS FOR HIGH-PRESSURE EQUIPMENT. *Chem. Eng.* **56**, 116-117 (1949) *September*.

The material used in the converter of the Bureau of Mines coal hydrogenation demonstration plant consists of 3% chrome, 0.65% nickel ond 0.3% molybdenum steel. The converter is 32 in. i.d. with 8¾ in. walls and is about 40 ft high. A three in. layer of asbestos is applied to the inside of the vessel. Low temperature piping is made of SAE-4130. Fittings were forged from billets and bar stock of SAE-1030. Flanges were forged from ASTM-A-105 Grade II. For temperatures to 850°F tubing material was Croloy 9 M, fittings were of 18-8 stainless and flanges were ASTM-A-182-44 Grade F-1. For the highest temperatures, above 850°F, tubing was 16-13-3 AISI Type 316, fittings were of the same material and flanges were 18-8 stainless. High temperature valves were of type 316 stainless with Stellite discs and seats.

W. J. Merwin

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